

COGNITIVE PSYCHOLOGY - AN EDUCATIONAL INSIGHT

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ABSTRACT

Cognitive psychology offers relevant insights into improving the teaching and learning process. The author has selected ten questions from a graduate class in cognition and learning taken at The Teachers College, Columbia University. The questions will be used to examine the most effective ways to learn and recall information.

INTRODUCTION

University teachers and students can experience frustration when classes become routine and boring. Educators can obtain helpful insights into the nature of learning from cognitive psychology. Courts and McInerney (1993) conducted an extensive investigation on student perceptions of their college instruction and students expressed disappointment with the heavy reliance on lectures and lack of interaction with their instructors.

Students related the following concerns:

- Students were not self-driven learners. They were not confident in their ability to approach a problem and figure it out on their own.
- The students evidenced a powerful sense that they were not learning as much as they should be.
- Many of the students voiced a belief that their college teachers do not really care much about them or about promoting their learning or interacting with them.
- The result is, students did not engage fully or energetically in learning something that they did not want to learn or see any reason for learning (pp. 33-38).

This research study highlights the complexity of the teaching and learning process and challenges educators those who are working online or in a more traditional setting to make learning more meaningful for students. The author has selected ten questions from a graduate class in cognition and learning taken at The

Teachers College, Columbia University (Hachey, 2005). The discussion focuses ten statements about learning and compare them to cognitive psychology research studies.

Ten statements of Learning and discussion of the result

1. Our senses capture the exact state of the world around us and store this information in short-term memory so the mind can analyze it

The statement is false. Research studies reveal that people have a brief storage for visual and auditory information. Anderson (2005) relates that the information captured by the sensory memories decay rapidly. The human memory does not record every detail of an experience or an event but only a portion of the information is kept as memories. Mandler and Ritchey (1997) note in their research that study participants could recall the subject of the teacher but not what the individual was wearing. Researchers have debated whether visual attention is like a spotlight or a zoom lens. Posner (1980) embraces the spotlight perspective that people only clearly see objects within a small range of them and they miss seeing objects outside this visual field. The zoom lens advocates propose that visual attention can be increased or decreased. Yet, both the spotlight and zoom lenses perspectives affirm that individuals can only visually attend to specific region or specific objects within their visual field.

Anderson (2005) relates that "different parts of the brain process verbal and visual information, and the information is processed in different ways" (p. 110). The cortex will use a visual image as form of topographic

representation to enable better neural processing of the data. Researchers found that when people view a set of pictures that their memory of the contents is enhanced when they create their own interpretation of the pictures. This affirms the important role of elaboration in building on information gathered from the senses (Anderson, 2005).

Bruning, et al (2004) noted that "retrieval is more than playing back an event from memory" (p. 107). Two students with similar amounts of education will write two different essay responses due to a variance in their ability to reconstruct information related to the exam. There are problems that can arise in accurately recalling the information from the senses. Individuals can struggle to retrieve data due to a mental block or some form of absentmindedness. Also, individuals can become confused because of having persistent thoughts involving inaccurate information.

2. We learn and remember only what we intend to learn and remember.

The statement is false. Cognitive psychologists have developed theories that have changed previous views on attention and recall. In the past, William James and his colleagues stressed the connection between an individual focusing on task and being aware of this fact. Anderson (2005) relates many unconscious attention operations such as the movement of eyes to view a particular event. Also, attention is multidimensional and there are differences between various types of attentions: auditory, visual and perceptual.

Research studies have noted distinctions between explicit and implicit memories. Explicit memories are considered conscious memories that the person is fully aware of and these are measured by recall or sometimes through recognition of items. "Implicit memory refers to unconscious or explicit recollections of changes in performance in the absence of conscious or explicit recollection of that experience" (Andrade & May, 2004, p. 60). Anderson (2005) relates that eyewitness narratives of automobile accidents and crimes can be inaccurate about the actual details. People sometimes have problems properly encoding events because they hear

information from other sources (e.g. media) which can create conflicting facts. Loftus (2003) did experiments with individuals who observed a traffic accident and related questions about a car speeding past an yield sign. The study participants spoke about the yield sign when in reality there had been none. Research studies on encoding indicate various problems with information processing, can create interference with knowledge of a past event and cause a memory distortion of the event. Loftus (1992) has stressed the problem of people accepting misleading information that becomes part of their recollection of the event. Eyewitnesses have a greater tendency to integrate post event information into their memories as they become further removed from the event.

3. The more practice you can pack into a given time period the better.

The statement is false. Research studies show that a key factor is how the information is integrated into the individual's memory. Research by Craik and Lockhart (1972) spoke of recall being strengthened by a deeper engagement with the material. Preservation and retention of learning information demands the use of metamemory strategies that help transfer the data to the long-term memory. The continuous repetition of words will only provide a temporary result of holding the information in the short-term memory (Anderson, 2005). The more effective rehearsal techniques encourage individuals to reflect upon the words and consider possible relationships between terms. Babrick and Phelps (1987) found that distributed practice sessions overtime were more effective for study participants than trying to bunch all the study sessions together. The research argues against studying intensely the night before a test in what is commonly known as cram sessions. Glenberg's (1979) studies on the spacing effect of learning sessions and suggest it can assist processing the knowledge into the long-term memory. Individuals will use the different study times to create a diversity of elaborations and memory cues to encode the data. Anderson (2005) argues that the combination of using distributed practice and learning the information in different contexts will increase

retention. When individuals develop study practices that make the words and information more relevant by relating it to previous knowledge or connecting the pieces of information together, that produce greater relevance and recall. Information processing and using elaboration techniques are essential to effectively recall knowledge. For instance, students find the recall knowledge easier from a novel than from a textbook. In reality, they are able to elaborate on material in the novel, which improves their ability to gain the knowledge because students are making the information more meaningful to their life experiences (Schacter, 1996).

4. When learning, people remember the meaning, rather than details, of what they see and hear.

The statement is true. The encoding process does begin with details but Anderson (2005) relates "memory for detail is available initially but is forgotten rapidly, whereas memory for meaning is retained" (p. 146). For instance, when an individual looks at a picture or a sentence their recall of the details decays rapidly. Gersbacher's (1985) research on people viewing two pictures revealed that after 10 minutes the study participants were only 57% accurate in knowing which pictures that they had just watched. The study participant's recall of details declined rapidly but over the 10 minute period of time they did have a solid recollection of the basic meaning of the pictures.

Anderson's (1974) study participants listened to a story which required them to listen to a series of sentences within the story. The subjects' capacity to recall the sentence that they heard declined after a two minute delay to an accuracy rate of 56%. Yet, study participants were able to identify the sentences that were logically connected to the story even with a delay with an accuracy of 96%. The findings affirm how individuals are able to recall meaning, but specific details are quickly forgotten.

Teachers can assist students by helping them broaden the range of cues that are associated in the encoding and retrieval of information in order that they can effectively recall the information in a larger range of

situations. Research studies on students reading a text in class have found that by asking questions and having guided peer discussion of the material enhances learning from the text (King, 1994). Questioning increased the student's elaboration of the information which made the knowledge easier to understand and helped them to better categorize and recall it.

5. Transfer can be improved by helping students to actively monitor their learning strategies and resources.

The statement is true. Instructors can promote cognitive processing skills by developing course materials and activities that reinforce reflective thinking. Cognitive psychologists stress the value of metacognition which Livingston (1997) defined as "thinking about thinking" (paragraph 2). The word focuses on the self-regulation or executive control of the cognitive processes. Flavell (1979) has described metacognition in three basic categories: individual knowledge about learning, knowledge of variables to complete a task and knowledge strategies. Metacognition skills play a significant role in the student's ability to succeed in higher education and being able to resolve daily problems or issues in their future jobs. Students must make a diversity of learning decisions based on the understanding of their skills and study habits. For instance, an individual might select a library over a university dorm room as being the best place to effectively study and prepare for an exam (Livingston, 1997).

Metacognition represents one aspect of today's information processing theories that have become more popular among educators. Students are encouraged to be proactive and cultivate their understanding of their own thinking skills to identify both their strengths and weaknesses. The self-regulation process involves planning, monitoring learning and taking steps to correct flaws in their learning (Branford, et al, 2000). Knowles (1990, p. 135) relates that learners demonstrate self-directed learning skills by:

- Diagnosing their own needs for learning
- Formulating their own learning objectives

- Identifying effective human and material resources for accomplishing their objectives
- Choosing and implementing effective strategies for using these resources
- Evaluating the extent to which they have accomplished their objectives.

Students can improve their ability to recall knowledge by implementing strategies that will be most helpful to them. Mnemonic devices organize information into segments that can help individuals recall data. Teachers can provide instruction on memory techniques by using methods that rely on a combination of visual imagery and spatial factors. Sternberg (2003) encourages the use of pegwords, categorical clustering, interactive images (e.g. connecting a word to a visual image), acronyms, method of loci and keyword systems.

6. Elaborating on the material you are studying is not a shrewd maneuver because it simply increases how much you have to remember.

The statement is false. The theory of short-term memory stresses the limited capacity to store information and the need to rehearse information to translate it into the long-term memory. Craik and Lockhart (1972) argue from their studies that the time devoted to processing information should be viewed as less important. Rather, deeply interacting with the material is essential for long-term recall. The elaboration process must be intentional to help individuals to trigger memory traces from their senses to their long-term memory. The levels of processing theories differ from researchers (e.g. Atkinson & Shiffrin) who held that rehearsal will always promote long-term memory. Anderson (2005) relates that "the theory called depth of processing, held that rehearsal improves memory only if the material is rehearsed in a deep and meaningful way" (p. 178). Therefore, individuals must engage in elaboration of ideas in a way that makes the material relevant to them. Students can use various tactics such as asking themselves questions before reading the material to heighten their personal ownership of the material (Anderson, 2005).

Research studies on elaboration have found there are

times that it is not always an effective method. For instance, when students tried to learn they can increase their recall by making the information distinctive or unique. The levels of processing theory is still being refined by researchers who are looking for ways to have a more comprehensive explanation of the mental interactions that occur during the elaboration process (Eysenck, 2001). Teachers can assist students by helping them broaden the range of cues that are associated in the encoding and retrieval of information in order that they can effectively recall the information in a larger range of situations.

7. It is a good idea to learn material in the same context in which you will be tested.

The statement is true but research results do reveal a degree of variance. Teachers should recognize that their student's ability to recall information is related to their emotional state and physical location. Research literature suggests the recall of information is directly connected to the individual's emotional state and the circumstances that they learned the material. Bruning, et al (2004) encourages teachers to provide similar testing and learning opportunities. Therefore, whenever a class is moved from their usual room to an unfamiliar room during a test, it could have a negative impact on student performance. "Contextual changes in a person's environment can cause added stress to the testing situation. Stressors cause a person's attention to shift, lapse, or narrow. The person's decision speed can be influenced as well" (Jacobs & Troester, 2004, Introduction, para 2).

Researchers have conducted experiments involving recalling information and contextual factors. Emmerson's (1986) study focused on divers who were practicing for an under water test under two different set of circumstances: one under water and the other on dry land. The divers who had practiced under water did perform better than those who had practiced on land. The underwater experiences provided the same context for the test and the divers became more familiar with working in the actual conditions of their future test. Jacobs and Troester (2004) tested the context-dependent theory of learning by

having students take tests in regular desks and beanbags. The results revealed that student accuracy for recall questions was higher in the beanbags, which were more comfortable and less stressful for the students. It did affirm the Yorkers-Dodson Law that stress or arousal must be consistent for individuals to perform at their optimal ability. Jacobs and Troester's research did not identify any significant differences between chairs in the recognition test questions. The authors speculated that switching the chairs was only a minor environmental change and it failed to have a major impact on student learning. The literature reflects a degree of variance in support of the context-dependent theory which points to the need for more research studies.

Branford, et al (2000) encourages teachers to emphasize understanding major concepts over memorization of detailed facts and teaching knowledge in a variety of contexts to promote a greater transfer of learning. Teachers should be concerned about presenting knowledge in ways that are too strictly "context bound" (Branford, et al, 2000, p. 236). It could restrict students in their capacity to apply knowledge in different circumstances. Teachers need to use discernment when selecting instructional activities for their students. Preparing students for SAT tests should focus on recreating the testing circumstances such as using time constraints and questions that are similar to the exam. The wise teacher will always strive to use the best techniques to promote enduring learning in their students.

8. *There is really no difference between declarative and procedural knowledge.*

The statement is false. Cognitive psychologists have created definite distinctions between declarative and procedural knowledge that are based on neurophysiologic studies. Declarative or explicit knowledge is factual oriented and the focus is mainly on knowing "what?". For instance, declarative knowledge is recalling one's personal memories like his/her father's birthday or how to spell a particular word. Procedural or implicit memory involves knowing how to perform various activities and it is "defined as memory without conscious awareness" (Anderson, 2005, p. 238). Procedural

memories can be seen in riding a bicycle, driving a car or doing a variety of other tasks. Also, procedural memories can play a role in helping people with having the information necessary to recognize words. It is interesting to observe that individuals who have learned how to ride a bike cannot explain what they have learned. Procedural knowledge is sometimes also called tacit knowledge which reflects how researchers have tried to explain this form of knowledge. Pritchard (2000) notes a distinction that "the difference between declarative memory and procedural memory is that one is static and the other is dynamic" (Long Term Memory, Para 5). Anderson (2005) views the acquisition of procedural knowledge and skills in three stages: cognitive (think about explicit rules), associative (extensive practice with the explicit rules), and autonomous (automatically use the rules). Procedural knowledge creates a set of rules that enable the individual to reduce or eliminate the need to locate information in their long-term memory while in the midst of a skilled work. Anderson's ACT model has shown a reasonable success when applied to learning skills such as computer text editing which have little variance in tasks (Eysenck, 2001).

9. *When we forget something we previously knew and could recall, it is because we may have inadvertently stored the item in short-term memory.*

The statement is false. The short-term memory can hold only approximately seven items or chunks of information. The amount of information can vary in size and smaller items of data can be encoded into larger units (Bruning, et al, 2004). Cognitive specialists have struggled in explaining the processes involved in forgetting. Decay theory advocates that information gradually disappears unless something is done to retrieve it. Decay theory is difficult to test because study participants rehearse information and this will distort the research results. Reitman (1974) devised an experiment that utilized a task that did not involve learning but required focused attention. Five words were visually presented to the study participants for two seconds and this was followed by a tone detection task using ear phones that lasted 15 seconds. Then, the individuals were asked to recall the five

words presented earlier. Recall of the words declined 24% within 15 seconds which Rittman viewed as the result of decay. The passage of time between initial memory and the retrieval of the original memory becomes more difficult and fades with time.

Interference theory explains forgetting due to two types of problems: retroactive interference where new memories interferes with previous memories and proactive interference where old memories disrupt new ones. Waugh and Norman (1965) asked study participants to view a series of 16 digits and the last digit was marked by a tone as the probe digit and the one needed to recall. The researchers found that the presentation rate of the digits did not influence performance. "Their results confirmed that the amount of information that intervened increased forgetting regardless of time (Bruning, et al, 2004, p. 27). Research studies using time delays for recall do show that proactive interference occurs more often and Sternberg (2003) views proactive and retroactive interference explanations as being complimentary. Therefore, studies point out that information does decay in short-term memory and forgetting information can be attributed to interference and problems with capacity in the short-term memory to retain data.

10. Experts and novices differ in their ability to recognize patterns of information.

The statement is true. Cognitive psychologists stress that it often takes ten years for a person to become an expert (Anderson, 2005; Schacter, 1996). Schacter (1996) relates that individuals who have " ...a highly refined and powerful form of elaborate encoding that enables experts to pick out key information efficiently and to imbue it with meaning by integrating it with preexisting knowledge" (p. 49). Simon and Gilman (1973) studied chess experts who had a working knowledge of 50,000 chess patterns. Chess experts demonstrate superior performance over novices who must continually work with novel situations. In contrast, chess masters have knowledge of an enormous number of patterns that enable them to recognize possible moves in a matter of seconds. Anderson (2005) notes that experts are able to effectively retrieve information from their long-term

memories. The template theory stresses the storage of relevant knowledge that chess experts can access to recall more and larger chess patterns than that of novices. Chess experts possess two kinds of expertise: routine and adaptive. The routine expertise enables the individual to do problem solving in an effective and timely manner. Adaptive expertise skills are those which help people to develop strategies that fit particular circumstances (Eysenck, 2001).

Research studies on experts have found that skill development and developing expertise were tied closely to the timing, quality and quantity of the deliberate practice. The use of mentors played a role by providing guidance, monitoring progress and establishing appropriate goals that would promote optimal growth. Bruning, et al (2004) notes that deliberate practice can help less talented people surpass the achievements of those with greater talents. Skill acquisition among young athletes, mathematicians and musicians indicates that individuals followed a similar learning routine. The key is having guidance and practice sessions that cultivate superior performance. "The best practice occurs under the watchful guidance of a skilled mentor who helps the developing expert set goals and monitor improvement" (Bruning et al, 2004, p. 177).

Educational Implications

Cognitive psychologists have provided enough evidence that improving student learning involves proper guidance. Two major adult education goals involve building student knowledge and fostering reflective thinking. These are lofty goals that demand constant attention and refinements. Research studies affirm having a social approach to intellectual growth and colleges and universities can offer opportunities for student reflection through group activities. Bruning et al (2004, pp. 209-210) describes eight practical ways to encourage critical thinking in today's classes:

- Take a broad perspective on knowledge.
- Develop student information-seeking skills.
- Organize instruction in ways that favor knowledge construction.

- Create a “thinking” classroom.
- Use discourse structures that promote reflection and knowledge construction.
- Use coaching and scaffolding to build student understanding.
- Consider decentralizing discussions.
- Make tolerance a basic rule for classroom discussion.

Conclusion

Students long for significant learning experiences that enrich their professional and personal lives. The teaching and learning process should be designed to meet student needs. Instructors shape the intellectual depth of their online and face-to-face classes by helping their students become reflective and self-directed learners. Cognitive psychologists challenge teachers to use their expertise and available resources (e.g. computer technology) to stimulate a genuine love for learning that transcends getting grades, but prepares them to be life-long learners.

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